

line; the elytra more or less powdered with a waxy secretion; the wing white, somewhat hyaline; head, thorax, body and femora very pale yellow; the antennæ and tibiæ blackish; large tuft of white waxy sponge-like matter at the end of body.

Expanse of elytra about 1 inch and 4 lines. Brit. Mus.

*Hab.* India (Silhet). In some specimens the red mark on the elytra is nearly obsolete, and the transverse black line is quite obsolete anteriorly.

*Pæciloptera (Flatida) tricolor*, White. Elytra pale green; anterior margin, especially at the base, reddish, the colour gradually verging into green; a few white powdery dots on the basal half, the under side washed with white. Wing white, somewhat powdered, the veins, especially at the base, greenish. Body and legs pale green.

Expanse of elytra about 1 inch 11 lines.

*Hab.* India (Silhet).

The front edge of wings near the base has a prominent angle, followed by a sinuation.

June 1846.

V.—*Remarks on certain Genera belonging to the Class Palliobranchiata.* By WILLIAM KING, Curator of the Museum of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne.

THE greatest discordancy of opinion has for some time prevailed with regard to the nomenclature and value of certain generic groups of the Palliobranchiate or Brachiopodous mollusks. A few years since, many palæontologists united such shells as *Leptæna rugosa* and *Productus Martini* in one group, to which they gave the latter generic name: J. De C. Sowerby\* and Professor Phillips† recognise the same association; but they discard the term *Productus* and adopt that of *Leptæna*: M. Bronn in the 'Lethæa Geognostica' agrees to the same union, but he rejects both names, and uses that of *Strophomena*. M. de Verneuil groups *Terebratula sacculus*, *Spirifer ambiguus* and *Atrypa reticularis* in one genus—*Terebratula*‡; J. De C. Sowerby would be disposed to make two genera of them; while Professor Phillips would have little hesitation in separating them into three. Bronn unites *Orthis testudinaria* and *Spirifer speciosus* under the genus *Trigonotreta*. Conrad and other American writers reject the generic name, which on this side of the Atlantic is applied to such shells as *Leptæna rugosa* and *L. euglypha*, and adopt for the same that of *Strophomena*. And Mr. McCoy has been led to im-

\* Silurian System, &c.

† Palæozoic Fossils of Cornwall, &c.

‡ Russia in Europe.

pose a new generic nomenclature in several cases where there are already too many synonyms.

But although this state of things exists, there is every reason for believing, from the progress which fossil conchology has made of late, that it is gradually passing to a termination: thus Professor Phillips has happily proposed *Hypothyris* for an extensive division of shells which have long complicated the genus *Terebratula*. Von Buch\* and a few others have judiciously restricted *Productus* to those shells agreeing with the one (*P. Martini*) which Mr. James Sowerby considered as typical of the genus. M'Coy has succeeded in establishing the genus *Martinia* for a number of forms that have been successively, but never satisfactorily placed in *Terebratula*, *Atrypa* and *Spirifer*. Koninek has skilfully cleared up Fischer de Waldheim's genus *Chonetes*. Verneuil, besides considerably advancing our knowledge of every palæozoic genus of the class, has clearly shown that the Orthises have no congeneric relationship to certain recent and tertiary *Terebratulas* as supposed by Philippi and others. And J. De C. Sowerby has done much towards unravelling the genus *Atrypa*.

In drawing up the remarks contained in this paper, though it is certain that many errors will be committed by myself, yet I hope to contribute something towards elucidating a subject involving many difficulties.

Before proceeding further, it is necessary to state, that as regards the nomenclature of the various genera to be alluded to, it is my intention to give preference to those names which are the earliest on record, however much the groups to which they were originally applied have been divided or enlarged, and provided they are not decidedly objectionable: it will therefore be at once understood, that I intend adopting the names *Terebratula*, *Productus*, *Spirifer*†, *Pentamerus*, *Strophomena*, *Leptæna*, *Atrypa*, *Chonetes*, &c. in preference to their substitutes *Epithyris*, *Trigonetreta*, *Delthyris*, *Cyrtia*, *Cleiothyris*, *Athyris*, *Leptagonia*, &c.

Having made these preliminary observations, I now proceed to give a synopsis of the various genera composing the class *Palliobranchiata* as far as I think is warranted by our present knowledge of the subject, after which I shall commence with my proposed remarks on certain of these genera.

\* Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin, 1841.

† In the 'Geology of Russia' (vol. ii. p. 40) M. Verneuil states that M. Fischer had the honour of being the first to separate from the *Terebratulas*, under the name *Choristites*, the shells which are now called *Spirifers*. The genus *Spirifer* was proposed in 1815, but *Choristites* does not appear to have been published prior to 1825.

*Synoptical Table of the Genera composing the Class Pallio-branchiata.*

<i>Families.</i>	<i>Genera.</i>	<i>Characteristic Species.</i>
Obolidæ .....	Obolus, <i>Eichw.</i> .....	Apollinis, Ingricus, &c.
Lingulidæ .....	Lingula, <i>Brug.</i> .....	anatina, Lewisi, antiqua, &c.
Orbiculidæ ...	Orbicula, <i>Lam.</i> .....	lamellosa, Buchii, &c.
Craniidæ .....	Crania, <i>Retz.</i> .....	anomala, <i>Müll.</i> ; spinulosa, striata, antiquissima, nummulus, antiqua, costata, &c.
	Siphonotreta, <i>Vern.</i>	unguiculata, verrucosa.
Calceolidæ ...	Calceola, <i>Lam.</i> .....	sandalina.
Strophomenidæ	Strophomena, <i>Raf.</i>	rugosa, <i>Raf.</i> ; alternata, oblonga, euglypha, Dutertii, Ouralensis, transversalis, Humboldti, imbrex, Fischeri, lepis, scricea, nasuta.
	Orthis, <i>Dalm.</i> .....	Pecten, eximia, crenistria, resupinata, Michelini, adscendens, anomala, zonata, calligramma, senilis, Verneuli, semicircularis, moneta, &c.
	Leptæna, <i>Dalm.</i> ...	rugosa, <i>Hising.</i> ; analoga, distorta, depressa; ? intermedia, <i>M<sup>c</sup>Coy</i> ; undulata, nodulosa.
	Chonetes, <i>Fisch.</i> ...	sarcinulata, papilionacea, minuta, volva, <i>M<sup>c</sup>Coy</i> .
Productidæ ...	Productus, <i>Sow.</i> ...	Martini, giganteus, punctatus, costatus, proboscideus, comoides, plicatilis, Nystianus.
	Strophalosia, <i>nobis</i> ...	spinifera, <i>nob.</i> ; Morrisiana, <i>nob.</i> ; subaculeata, <i>Murch.</i> ; horrescens, <i>Vern.</i> ; productoides, <i>Murch.</i> ; ? spinulosa; <i>Gerardi, nob.</i> , &c.
Terebratulidæ	Terebratula, <i>Lwyd.</i>	vitrea, sanguinea, Sowerbyi, Chilenensis, dorsata, Natalensis, caputserpentis, rosea, truhcata, sacculus, hastata, orbicularis, oblonga, digona, obovata, variabilis, <i>Sow.</i> ; longirostris, &c.
	Hypothyris, <i>Phill.</i> ...	cuboides, anisodonta, pugnus, acuminata, Meyendorfi, Wilsoni, inconstans, plicatilis, psittacea, pleurodon, decussata, Voltzii, rostrata, excavata, obsoleta, &c.
	Pentamerus, <i>Sow.</i> ...	Knightii, conchidium, lævis, galeatus, Bashkiricus, oblongus, borealis, &c.
	Camerophoria, <i>nob.</i>	Schlotheimi, superstes, multiplicata, <i>nob.</i> ; globulina, <i>Phill.</i>
	Uncites, <i>Defr.</i> .....	Gryphus.
Spiriferidæ ...	Spirifer, <i>Sow.</i> .....	cuspidatus, Mosquensis, speciosus, heteroclitus, cheiropteryx, cristatus, Walcottii, trapezoidalis, cardiospermiformis, lynx, rotundatus, planatus, trigonalis, &c.

Families.	Genera.	Characteristic Species.
Spiriferidæ ... (continued).	<i>Atrypa</i> , <i>Dalm.</i> .....	<i>reticularis</i> , <i>desquamata</i> , <i>prunum</i> , <i>tumida</i> , <i>concentrica</i> , <i>pectinifera</i> , <i>lamellosa</i> , <i>expansa</i> , <i>fimbriata</i> , <i>planosulcata</i> , <i>Helmersenii</i> , <i>am-</i> <i>bigua</i> , ? <i>Mantia</i> , ? <i>serpentina</i> , <i>le-</i> <i>pida</i> , <i>ferita</i> , &c.
	<i>Martinia</i> , <i>M'Coy</i> ...	<i>glabra</i> , <i>rostrata</i> , <i>Schl.</i> not <i>Zeiten</i> ; <i>hyalina</i> , <i>lineata</i> , <i>lævigata</i> , <i>strigo-</i> <i>cephaloides</i> , <i>pachyrhynchus</i> , <i>la-</i> <i>bellum</i> , &c.
	<i>Strigocephalus</i> , <i>Defr.</i>	<i>Burtini</i> , <i>dorsalis</i> , &c.
Thecideidæ ...	<i>Thecidea</i> , <i>Defr.</i> ...	<i>Mediterranea</i> , <i>recurvirostris</i> , <i>ra-</i> <i>diata</i> , <i>hippocrepis</i> , <i>hieroglyphica</i> , &c.

Respecting the generic arrangement adopted in the foregoing table, it requires to be mentioned that I do not claim any consideration for its being a natural one. My opinion is that no linear arrangement can represent the true relationship pervading the various genera of any class of animated nature. On this subject I have elsewhere offered my views\*, and it is my intention shortly to extend the same to a classification of the mollusks under consideration.

#### ATRYPA, &c.

Many palæontologists are evidently unwilling to recognise the genus *Atrypa*: Dalman its founder, as is often done, included in it some very different shells, as *Atrypa reticularis*, *A. galeata* and *A. nucella*, inasmuch as the first is furnished with a pair of spiral appendages†, the second possesses the internal structure peculiar to the Pentameruses, and the third does not appear to be distinguishable from *Hypothyris*; it therefore follows that the genus requires to be considerably restricted. In this case we must not overlook the species which Dalman first described, viz. *Atrypa reticularis*, Linn., as we are compelled to consider it as the typical one.

As its founder included a variety of forms in *Atrypa*, it is to be expected that others would err in the same manner; thus J. De C. Sowerby‡ includes in it the filose Spirifers of Phillips, and such shells as *Terebratula pugnus*, Sow., &c., which belong to other genera, the former generally to *Orthis* and the latter to *Hypothyris*. Mr. Sowerby has however been more fortunate with such species as *Spirifer expansus*, Phill., and *S. planosulcatus*,

\* Vide Annals of Natural History, vol. xiv. pp. 271 and 272.

† Defrance was the first to make known the presence of these appendages in *Atrypa reticularis*. (Vide *Spirifer Sowerbyi* [= *A. reticularis*] in the 'Dictionnaire des Sciences Naturelles,' tome 50.) I have a specimen from the Eifel exhibiting the same appendages.

‡ Mineral Conchology, No. 108.

Phill., since they agree with the typical species of *Atrypa* in being furnished with spiral appendages.

Without being aware that so important a part as the spiral characterized them; Dalman included in the genus his *Atrypa tumida* and *A. prunum*\*, both of which in external characters approximate the two species cited at the close of the last paragraph.

M. Verneuil, in merging *Atrypa* into *Terebratula*, has been influenced by an opinion that few will now contend for: he supposes that the spirals found in the shell of the former are the same as the labial processes belonging to the mollusk of the latter †, whereas they are merely the supports of these processes, and therefore homologous with the internal armature of *Terebratula*. The figures which Mr. McCoy has given of the spiral appendages of *Spirifer*, &c., in the 'Synopsis of the Carboniferous Fossils of Ireland,' p. 127 &c., clearly show that they are attached to the hinge of the imperforate valve, which could not be the case if they had been the labial processes themselves.

The armature of *Terebratula* and the spirals of *Atrypa* having been shown to serve the same office, it may be maintained that this still shows the necessity of discarding the last genus. There would have been some grounds for this if *Atrypa* possessed an internal apparatus as variable as that of *Terebratula*, but considering the constancy of form of the spiral appendages, and their persistency over an extensive number of shells (that is, the *Atrypas* in the present case) related to each other by affinity and geological age, it is impossible to consider them otherwise than as constituting a character which separates the shells under consideration generically from the *Terebratulas*.

*Atrypa* is distinguished from all the spiral-bearing genera by the general absence of an area ‡ and the frequency of a foramen;

\* I have Swedish specimens of these species exhibiting the spiral coils.

† Geology of Russia, vol. ii. pp. 47, 48, &c.

‡ As several new terms are used in this paper to express various parts of a Palliobranchiate shell, and as several old ones are somewhat differently employed to what they are in general, I embrace the present opportunity of entering into the following explanations:—Palliobranchiate shells generally articulate by means of two teeth or "condyles," situated on the hinge of the foraminal or "dorsal" valve, and a pair of depressions or "sockets" excavated in the corresponding part of the opposite or "ventral" valve. The two plates seen in the rostral or umbonal cavity of the *Spirifers*, &c. have been described by Von Buch as "les lamelles de soutien des dents," because they are connected with or appear to support the condyles: the expression may therefore be conveniently translated into "condyle plates." On the dorsal valve of *Spirifer*, *Leptaena*, *Strophomena*, *Thecidea*, *Martinia*, &c., and in certain species of other genera, as *Terebratula truncata*, *Hypothyris rostrata*, &c., are to be seen two flat spaces, one on the outer side of each of the condyles; these spaces constitute what is generally called the "area."

the last character is however variable, even in the same species : thus some varieties of *Atrypa reticularis* from the Eifel have it apical and entire ; others, subapical and entire ; others again have it apical and emarginate ; and others, subapical and emarginate ; even some varieties have a well-defined area. Generally however the foramen is apical and emarginate, being notched inferiorly by an open but concealed deltidium, as in *Atrypa concentrica*, *A. Roissyi*, *A. pectinifera*, *A. prunum*, *A. tumida*, &c.

In all the dentigerous Palliobranchs, a triangular space intervenes between the condyles ; this it is proposed to term the "*deltidium*:" when open, as in certain Spirifers, &c., it may be termed an "*open deltidium*," and when closed or cicatrized, as often occurs, a "*cicatrized deltidium*:" it is "*concealed*" in the *Atrypas* generally, and in certain species of other genera, as *Pentamerus Knightii*, &c. (in consequence of being occupied by the umbone of the ventral valve), and "*exposed*" in the Spirifers, Martinias, Orthises, Leptænas, Strophomenas, &c., and in certain species of other genera, as *Pentamerus conchidium*, *Atrypa ferita*, &c. The part forming a cicatrized deltidium may be named the "*cicatrix*." The umbone of the *Terebratulas* is furnished with an aperture which is generally termed the "*foramen*;" it is "*apical*" when situated at the point of the beak (*Terebratula dorsata*, &c.), and "*subapical*" when placed below the point (*Hypothyris*) : often it is notched inferiorly by an open deltidium, as in *Atrypa Roissyi*, &c., in which case it is an "*emarginate foramen*;" when not in this state it is an "*entire foramen*:" in *Terebratula dorsata* it is "*entire and apical*," in *Hypothyris obsoleta* "*entire and subapical*," in *Atrypa Roissyi* and *Terebratula caput-serpentis* "*emarginate and apical*," and in *Hypothyris psittacea* "*emarginate and subapical*." The distinction between a foramen and a deltidium is necessary, as the former in all cases served as a passage for the pedicle ; but the latter, as in some Spirifers, *Hypothyris excavata*, *Pentamerus conchidium*, &c. (which have an open deltidium), only occasionally answered this purpose : when it was necessary for a shell with a cicatrized deltidium to be attached by means of a pedicle, the cicatrix was perforated as exemplified in *Spirifer heteroclitus*, *Orthis ascendens*, &c. : in *Leptæna*, although the deltidium is open, it could not serve as a passage for the pedicle in consequence of being completely occupied by a prominency situated on the hinge of the ventral valve. The condyle sockets are often bounded inwardly by a ridge or wall (hence the name "*socket-wall*") which is occasionally prolonged into the cavity of the shell under the form of a plate, as in *Orthis eximia*, &c. ; to distinguish the two resulting plates from those of the dorsal valve, it will be convenient to name them "*socket-plates*." Besides being occasionally prolonged, the socket-walls are generally expanded laterally under a lamellar form ; occasionally these lateral expansions remain separated (*Terebratula variabilis*), but in general they are connate (*Terebratula dorsata*, *Hypothyris rostrata*, &c.) and form a single plate ; as this plate generally serves as the base of the "*crura of the loop*" (Owen), it is proposed to term it the "*crural base*:" it is "*concave*" in *Terebratula dorsata*, "*flat*" in *Hypothyris rostrata*, and "*divided*" in *Terebratula variabilis*. The crural base is often supported by a plate extending along the medio-longitudinal line of the shell ; the dorsal valve occasionally possesses a similarly situated plate : both may be termed individually a "*mesial plate*." Care must be taken not to confound the socket-plates with two ridges to be seen diverging from the centre of the hinge and traversing the muscular impressions in certain shells (*Orthis Verneuli*, &c.) : these appear to have been produced by two large vessels belonging to the vascular system of the mollusk.

In the synoptical table the genera *Spirifer*, *Martinia*, *Atrypa* and *Strigocephalus* are grouped under the family *Spiriferidae*. By restricting the family to these genera, I am led to believe that no point is involved that can in any respect embarrass a natural classification of the great class to which it belongs; at the same time, there is little doubt that it forms a remarkably homogeneous group, inasmuch as its species, there is every reason for supposing, were tenanted by a mollusk furnished with labial processes that were immovably fixed to a pair of spirally folded supports. This character of the labial processes is fully warranted by the recent *Terebratulas*, in which the same parts are immovably fixed to a more or less complicated loop. The spiral form of the labial processes, their immobility, and their spirally folded supports, are characters which eminently distinguish *Spiriferidae* from every other Palliobranchiate family.

The spiral-bearing shells are found under so many different forms as to have induced some to arrange them under a number of genera, but I am led to believe that the principal part of them are inadmissible, having been founded on characters highly fugacious, or transitional, and proposed without a due consideration of the claims of previous writers: thus *Cyrtia* was not only based on a highly mutable character, but it was anticipated by *Spirifer*, the typical species of which (*S. cuspidatus*) possesses the same characters as *Cyrtia trapezoidalis*—the type of Dalman's genus. *Delthyris* and *Trigonotreta* are equally inadmissible on the same grounds. *Brachythyris*, M'Coy, has been anticipated by *Choristites*, Fischer, which is founded on too transitional a character. *Actinoconchus*, M'Coy, if admitted, would render necessary the separation into so many genera, of such shells as *Atrypa planosulcata*, *A. pectinifera*, *A. fimbriata*, *A. Roissyi*, *A. reticularis* and *A. aspera*, because their marginal plates are severally planosulcated, pectinated, fimbriate, setigerous, flounced, &c. And as regards *Athyris*, M'Coy, and *Cleiothyris*, Phill., they have been anticipated by *Atrypa*, whose name, notwithstanding its being in several cases a misnomer, ought not on that account I conceive to be now discarded. Certain objections might be urged against the genus *Martinia* of M'Coy, but they do not appear to be sufficiently strong to prevent its adoption; by its possessing an area and an exposed deltidium, *Martinia* may be readily distinguished from *Atrypa*—the genus with which it stands the most chance of being confounded. *Reticularia*, M'Coy, does not appear to possess characters sufficient to warrant its separation from *Martinia*.

#### TEREBRATULA and HYPOTHYRIS.

Mr. James Sowerby was the first to draw a distinction between

the smooth and the plicated *Terebratulas*\*. Afterwards M. von Buch, in his memoir 'Uber die Terebrateln,' on account of the same difference, divided them into the two divisions "*Plicata*" and "*Non-plicata*." Still later, Professor Phillips, in his 'Pælaeo-zoic Fossils of Cornwall,' &c., elevated the *Terebratulas* to the rank of a family under the name *Cyclothyridæ*, which includes two genera, *Epithyris* and *Hypothyris*, the former having the "beak truncate, perforate," and the latter the "beak acute, the perforation below it:" *Hypothyris* agrees with the plicated and *Epithyris* with the non-plicated divisions of Sowerby and Von Buch. More recently, Mr. M'Coy, in the 'Synopsis of the Mountain Limestone Fossils of Ireland,' has divided the family *Terebratulidæ* into five genera, *Atrypa*, *Semiluna*, *Delthyridæa*, *Cyclothyris* and *Terebratula*: the last two only merit our attention at present, as they correspond with the genera proposed by Professor Phillips. In the same year that Mr. M'Coy's observations appeared, Dr. Carpenter, at the York Meeting of the British Association, read a report "On the Microscopic Structure of Shells," in which the *Terebratulas* are divided into two sections, the "perforated" and the "non-perforated," *that is, with reference to the arrangement of the tissues composing the shell*: these sections are also in exact correspondence with the two divisions under consideration †.

It will now be evident that the *Terebratulas*, from the year (1815) in which Mr. J. Sowerby's views appeared to the present period, have been grouped under two leading divisions, and that these divisions have been proposed with reference to three sets of characters totally distinct from each other: a stronger proof of the necessity of elevating them to the rank of genera cannot be required.

Before proceeding further, it will be necessary to make a few remarks on the names which have been proposed for the two genera so clearly established. If we agree to those of Professor Phillips, the old name *Terebratula* will be expunged from conchology: this I am strongly disposed to think will scarcely be sanctioned: I am therefore induced to prefer *it* to the proposed substitute *Epithyris*. It is now difficult to say whether the name *Terebratula* was first applied to the smooth or the plicated spe-

\* Mineral Conchology, vol. i. p. 189.

† There seems to be an error in Dr. Carpenter's list of "non-perforated" species, as it contains *Terebratula variabilis* (of Sowerby, not of Schlotheim I presume), which, judging of its form, &c., appears to belong to the perforate division: this is in a great measure proved by the fact, that the same shell is represented in the illustrations with a perforate tissue (vide Report of the British Association for 1844, plate 17. fig. 39). Has not a similar mistake occurred with *Terebratula subrotunda*?



cies, but as the former are those first described by Bruguière, Lamarck and others, I am led to think that its retention for them will meet with general approval. Respecting the names *Hypothyris*, Phill., and *Cyclothyris*, M'Coy, for the plicated species, the former having the priority ought to have the preference.

My next object will be to attempt to define the limits of the genera *Terebratula* and *Hypothyris*. Besides the smoothness or plication of the valves, the apical or subapical position of the foramen, and the perforate or imperforate texture of the shell, there are other characters which appear to be generally useful in distinguishing these genera; thus the species of *Hypothyris* may in general be distinguished from those of *Terebratula* by the greater or less sinuosity of their frontal margins. In the synoptical table, *Terebratula psittacea* is placed in *Hypothyris* from its possessing an acute apex, a subapical foramen, and an imperforate shell-tissue: this species suggests the probable existence of other distinguishing characters; for example, in *Hypothyris* the internal apparatus may be simple, and the labial appendages of the mollusk attached only at their base: judging of existing *Terebratulas*, the latter are attached nearly throughout their entire length to a complicated apparatus. We are not yet in a position to urge these differences with any degree of certainty, particularly with respect to the labial processes, since, of the genus *Hypothyris*, the animal of only a single species (*H. psittacea*) is known; and as regards the apparatus, we are still but imperfectly acquainted with its structure in the fossil species of either genera. In *Hypothyris* the armature appears to be exceedingly simple, consisting only of two disunited processes passing from the hinge of the imperforate valve into the cavity of the shell; but in *Terebratula* these processes are united anteriorly, thereby forming a loop, which is more or less folded and complicated according to species\*. Much care is required in ascertaining whether the disunited processes and the loop are really distinguishing characters in these genera, since in fossil species the latter may be broken in such a manner as simply to exhibit its two *crura*, which will then resemble the former. M. Verneuil has evidently been misled by a circumstance of this kind in representing *Terebratula elongata* with disunited processes†, as several specimens of this species in my collection clearly exhibit it furnished with a folded loop; and I suspect that Mr. M'Coy has been similarly deceived in stating

\* In *Terebratula dorsata* the loop is simply attached to the crural base; in *T. chilensis* it is attached both to the crural base and to the anterior part of the mesial plate; in *T. rosea* it is only attached to the mesial plate. The apparatus of the last species explains the erect forked process seen in the centre of the ventral valve of *T. natalensis*.

† Geology of Russia, vol. ii.

that *Terebratula hastata* possesses "two flat triangular laminæ\*." Finding the loop in the existing *Terebratulas* in the Permian *T. elongata* goes far to prove that it is general in the genus. I have also seen it in the Jurassic *Terebratula trilineata* collected in Glaizedale, Yorkshire.

As might be expected, there are several species which it is difficult to place in their true genus; but where so many characters are available, some, or one at least, may be found to assist us. *Hypothyris decussata* (*T. coarctata*, Sow.), in consequence of having the "beak truncate, perforate," one would be disposed to place it in *Terebratula*; but as Dr. Carpenter has ascertained that its shell-tissue does not exhibit any perforations, it has on that account been placed in *Hypothyris*. *Terebratula truncata* has a subapical foramen, and therefore might be included in *Hypothyris*, but this is strongly opposed by its possessing a loop and by the texture of its shell. *Hypothyris psittacea*, from the absence of decided plications, would not have been thus generically designated, but for its subapical foramen and imperforate shell-tissue†. *Hypothyris Meyendorfi* appears to have a truncate, perforate beak, but its deep frontal sinus and its indisputable affinity (another point not to be overlooked) to *H. acuminatus* and *H. pugnus*, in which the foramen is subapical, are clearly in favour of the generic allocation adopted in the synoptical table. A few more species remain to be noticed, viz. *Terebratula oblonga*, *T. orbicularis* and the so-called *T. rostrata*: all of them have the plicated character of *Hypothyris* joined to the form usual to *Terebratula*; but the apical foramen of *T. oblonga* and *T. orbicularis* proves that they are true *Terebratulas*, while the subapical position of the foramen in *T. rostrata* shows that it belongs to *Hypothyris*: in the case of two of these species this generic allocation is completely confirmed by the researches of Dr. Carpenter, who has ascertained that *T. oblonga* possesses a perforate and *T. rostrata* an imperforate shell-tissue.

In speaking of the internal structure of *Terebratula* and *Hypothyris*, I have refrained from alluding to the two condyle plates to be seen in the rostral cavity of certain species, for this reason, that they are found in both genera, though not so frequently in

\* Synopsis of the Carboniferous Fossils of Ireland, p. 153.

† *Hypothyris psittacea* has occasionally been suggested to belong to *Atrypa*: by restricting this genus to the spiral-bearing shells included in it in the synopsis, *Hypothyris psittacea* will necessarily be excluded. The difference between the mollusk of the one and that of the other appears to have been considerable, since in *Atrypa* the labial appendages were in all probability completely attached to spiral supports and therefore immobile; but in *H. psittacea*, notwithstanding their spiral form, they undoubtedly possess considerable motion. [Vide Professor Owen's Memoir on the Anatomy of the Brachiopoda, Zoological Transactions, vol. i. p. 150.]

the former as in the latter. They do not appear to have been noticed in any tertiary and recent Terebratulas: they are to be seen in *Terebratula digona*, *T. obovata* and *T. oblonga*, but are absent in many others agreeing with them in geological age, from which I am led to believe that they are only partially present in the secondary Terebratulas: they appear however to be general to the palæozoic species. With some exceptions, as in certain cretaceous and other species, the condyle plates are to be found in all the Hypothyris living and extinct.

In addition to those given in the synoptical table, the family *Terebratulidæ* has been made to include other genera, as *Trigonomemus*, König, *Rynchora*, Dalman, *Magas*, Sowerby, *Pygope*, Link, *Delthyridæa*, M'Coy, *Semiluna*, &c. As I am not sufficiently acquainted with secondary species to pass an opinion on these groups, I will leave to others better qualified than myself the task of analysing them. The genus *Semiluna*, M'Coy, I am strongly disposed to think is founded on young Hypothyris.

#### STROPHOMENA and LEPTÆNA.

It is now a generally received rule that "the name originally given by the founder of a group or the describer of a species should be permanently retained to the exclusion of all subsequent synonyms\*." This is especially applicable to a group of Pallio-branchs next to be considered.

Many years ago Rafinesque proposed the genus *Strophomena*: I do not know the exact time of its publication, but for a certainty it was previously to 1825, as Blainville adopted it in his 'Manuel de Malacologie,' published in that year. The genus is thus described by Blainville:—"Coquille équilatérale, régulière, subéquivalve; ayant une valve plate et l'autre un peu excavée; articulation droite, transverse, offrant à droite et à gauche d'une subéchancrure médiane, un bourrelet peu considérable, crénelé ou denté transversalement; aucun indice de support." The illustrative species (*Strophomena rugosa*, Raf.) figured in the 'Malacologie' is evidently closely allied to and congeneric with *Leptæna alternata*.

Subsequently to Rafinesque, Dalman (in 1827) proposed a new genus under the name of *Leptæna*, in which he included the so-called *Leptæna rugosa*, *L. depressa*, *L. transversalis* and *L. euglypha*, which have generally been considered to belong to the same genus as *Strophomena rugosa*. It is thus evident that the name *Strophomena* has the priority over that of *Leptæna*, which is the reason, it may be presumed, why so many continental and

\* Report on Zoological Nomenclature, British Association Report for 1842.

American writers prefer Rafinesque's to Dalman's. Be this as it may, it is not my intention to adopt the one in preference to the other, as it is my opinion that both names can be advantageously retained.

The genus *Leptæna*, as constructed by Dalman, evidently includes two different groups of species, *Leptæna depressa* and *L. rugosa* constituting the one, *L. transversalis* and *L. euglypha* the other. These were the only species known to Dalman; since his time several others of both divisions have been discovered.

It is now difficult to say which species Rafinesque considered as typical of his genus; our only alternative is then to ascertain the type of Dalman's. The committee to whose labours I have already been indebted, state, that "when authors omit pointing out the type of the genus, it may still in many cases be correctly inferred that the first species mentioned on their list, if found accurately to agree with their definition, was regarded by them as the type\*." As *Leptæna rugosa* answers in every respect to these terms, it follows that this species ought to be regarded as the type of the genus; and considering the claims which Rafinesque's name has to priority, we are to a certain extent warranted in applying the name *Strophomena* to the group represented by *Leptæna transversalis* and *L. euglypha* †.

It will now be necessary to point out the differences between *Leptæna* and *Strophomena*. Both valves of *Leptæna* are more or less wrinkled transversely: when the shell is young they are flat; afterwards their frontal margin becomes inflected, which is permanent in the dorsal or deltidial valve, but evanescent in the opposite one, as its front soon becomes acutely deflected or folded upon itself outwardly: by this means the frontal margins do not meet each other, as in the Terebratulæ, and as they at first affected, but the anterior part of the upper valve overlaps that of the under one, the inner surface of the one facing that of the other at the same time. On the other hand, *Strophomena* has plain valves, that is with reference to the wrinkles, and it is in general regularly concavo-convex ‡, the convexity usually

\* Report of the British Association for 1842, p. 111.

† If it cannot be ascertained which species Rafinesque considered as the type of *Strophomena*, the *S. rugosa* figured in Blainville's 'Malacologie' ought to be looked upon as the typical one; and in this case we are bound to adopt Rafinesque's name, inasmuch as this species belongs to the group represented by *Leptæna transversalis* and *L. euglypha*.

‡ *Strophomena* and *Orthis* merge into each other by means of their flat species. Fischer de Waldheim, in proposing the genus *Orthotetes*, has evidently had in view some of these merging forms; but the fact of Dalman's typical species of *Orthis* (*O. pecten*) being also apparently the type of Fischer's, the former genus necessarily falls to the ground. What is the genus *Hipparionyx* of Vanuxem?

answering to the deltidial valve\*. There are one or two more differential characters which ought not to be overlooked in drawing up a *diagnosis* of these genera: for example, in *Leptæna* the deltidium is open and wide at the base, but in *Strophomena* it is usually narrow and cicatrized; and the hinge plates are often crenulated in the latter but generally smooth in the former†. As regards internal characters, they appear to be more inconstant in *Strophomena* than in *Leptæna*: *Strophomena Dutertrii* has the muscular fulcra of the ventral valve elevated, curving over the mesial plate and united, by which means they form an arch-shaped process‡; while in *S. deltoidea* they are reduced to mere impressions: in *S. lepis* the fulcra of both valves are slightly elevated, and resemble those of *Chonetes*: certain species, as *S. transversalis*, *S. Humboldti* and *S. oblonga*, have lateral (? ovarian) spaces, one or more on each side of the mesial line, bounded by a prominent ridge, as occasionally seen, though less obviously, in *Chonetes*; but in most of the genus there is no appearance of a bounding ridge: in general the vascular system has not left any impressions on the inner surface of the valves,—the exception, as far as I have been able to ascertain, occurs only in *Strophomena lepis*, which in this respect resembles the *Leptænas* generally. The very converse of this mutability of internal structure prevails in *Leptæna*, the species of which are remarkable for the similarity of their muscular fulcra, for generally exhibiting impressions of the vascular system, and for the general absence of ovarian (?) bounding ridges. Some of the *Leptænas* arrest our attention by their being foraminated; that is, besides possessing an open deltidium, they are furnished with a circular opening in their slightly prominent beak. I possess several specimens of a species, apparently the same as *Leptæna analoga*, from the carboniferous shales of Northumberland, exhibiting the foramen in a very obvious manner; whether it is general to the genus I cannot say. My Swedish specimens of *Leptæna rugosa* do not appear to possess this character, but it is seen in an allied species from the Eifel. *Strophomena alternata* possesses a similar opening, which is the only instance in this genus that has been made known§; but it does not appear to be

\* I know of only one exception, which obtains in *Strophomena euglypha*: in this species the deltidial valve is the concave one. The like exception probably occurs in *Orthis*, since *O. crenistria* and some other species have the same valve affecting the concave form.

† *Leptæna nodulosa*, Phillips, has crenulated hinge plates.

‡ This at least is the view I formed from a hasty examination of this singular apophysis in a specimen belonging to the beautiful collection of Mr. W. A. Lewis of Wolverhampton. I have specimens of *Productus Martini* and *Leptæna analoga* (?), in which the muscular fulcra are unusually elevated and curved over the mesial plate, but they do not coalesce as in *Strophomena Dutertrii*.

§ Geology of Russia, vol. ii. p. 225, &c.

situated as in *Leptæna*, in the beak itself, but in the apex of the cicatrix of the deltidium: in this respect *Strophomena alternata* corresponds with *Orthis anomala* and *Spirifer heteroclitus*. The foramen in *Leptæna analoga* becomes closed in old individuals, as occasionally occurs in *Terebratula*.

It is highly in favour of there being a valid generic distinction between *Strophomena* and *Leptæna*, when, out of a large number of species at present known, there is little difficulty in placing them either in the one genus or the other. Though I am not aware of it being the case, it is nevertheless probable that species will yet be found rendering a generic allocation a matter of some difficulty.

Previously to entering upon the next genera to be noticed, it will be necessary to make a few remarks on the muscular system of *Terebratula*, in order that the use of certain parts to be mentioned hereafter may be properly understood. From a specimen of *Terebratula dorsata*, at present before me, containing the entire muscular system desiccated, and freed of the visceral mass, I have drawn up the following details:—The rostral or umbonal cavity is occupied with a dense fibrous cylindrical body called the *pedicle*: considering the convexity of the foraminal valve as the upper side of the shell, the inferior end of the pedicle fits into the foramen; while its superior end, which is somewhat flattened or dilated in the transverse direction of the shell, is situated at the entrance or anterior part of the rostral cavity, to the surface of which it appears to be attached by means of tendinous or membranous chords,—the truncated extremity of the pedicle itself not being adherent. A little in advance of the upper extremity of the pedicle, three pairs of muscles pass off to different parts. The outermost pair (which consists of those muscles implanted nearest the lateral margins of the valve) passes at a slight angle into the upper part of the pedicle: within these muscles, and somewhat in front of them, another pair passes downwards (slightly converging at the same time), and becomes attached to a flattened prominence situated in the centre of the hinge of the lower or imperforate valve. To distinguish these pairs of muscles from each other, it will be necessary to name the former the *superior pedicle muscles*, and the latter the *cardinal muscles*. In close proximity to the superior end of the pedicle, and a little behind, and within the cardinal muscles, and therefore near the medio-longitudinal line of the shell, is situated the origin of the remaining pair, which passes directly down to a little behind the centre of the opposite valve, each muscle at the same time becoming dichotomous in its inferior half: these may be termed the *valvular muscles*. Besides supporting the cardinals and the

valvulars, the imperforate valve affords attachment to other two muscles which pass upwards from the *crural base* (where each one is divided), and become inserted in the upper part of the pedicle: it is proposed to name these the *inferior pedicle muscles*. With one exception, the foregoing description agrees with that given by Professor Owen in his memoir "On the Anatomy of the Brachiopoda\*," in which it is stated, that the muscles which have been termed the valvulars pass into the upper part of the pedicle,—a statement which I am led to suspect may have arisen simply from the superior termination of these muscles in the specimens examined by this distinguished anatomist having been so close to the upper part of the pedicle as to appear as if attached to it.

#### PRODUCTUS, &c.

An examination of a number of Palliobranchiate fossils has convinced me that a muscular system similar to that of *Terebratula dorsata* characterized the genera *Productus*, *Leptæna*, *Strophomena*, *Orthis*, *Spirifer* and *Chonetes*. In the deltidial or corresponding valve of these shells, there are impressions answering to the six muscles which have been described as passing from the same valve of *Terebratula dorsata*; and in the opposite valve there are impressions corresponding to the four terminal divisions of the valvulars, and the hinge is generally furnished with a prominence which has clearly served as a fulcrum for the cardinals†. It is necessary to mention that it is only in certain species of these genera that the muscular impressions can be made out; in general they are confluent, in which case it is difficult to define them‡. I have not yet seen any positive indication of impressions in these fossils answering to the two muscles passing from the *crural base* to the upper part of the pedicle: I am strongly disposed however to think that this does not arise from the absence of such muscles, but rather from their not having produced impressions strong enough to remain visible—a supposition that cannot be objected to, considering how very faint the impressions of the inferior pedicle muscles are in *Terebratula*§.

\* Transactions of the Zoological Society of London, vol. i. p. 151.

† Those fossils which have no cardinal prominence, as certain *Orthises*, *Spirifers*, &c., have nevertheless impressions in the centre of the hinge, which clearly show the cardinal muscles were neither abrogated nor implanted elsewhere. *Hypothyris psittacea* serves as an exceptional case in another genus.

‡ In a "Monograph of the Invertebrate Fossils of the Magnesian Limestone of the County of Durham," which I am preparing for publication, a more detailed account will be given of the muscular system, &c. of most of the genera mentioned in the text, together with numerous illustrative figures.

§ In *Orthis Michelini* the inferior pedicle muscles appear to have been attached to the *socket-walls* or *socket-plates*, as their surface displays marks of muscular attachment.

The whole of the impressions noticed in the last paragraph are best seen in certain *Productuses*. The two large striated impressions on the convex valve of *Productus giganteus* I have satisfied myself are due to the superior pedicle muscles\*. Within these, and on a flattened elevation, are situated four other impressions curiously ramified; they are often confluent, but occasionally specimens exhibit them separated. Two of these impressions (probably those situated anteriorly) I consider are due to the valvulars, and the other to the cardinals: the former muscles, according to this view, have necessarily produced the ramified impressions generally to be seen on the flat or opposite valve†. The tubercle on the centre of the hinge of the flat valve has commonly been considered a tooth, but the impressions which it displays, and its agreement in position with the cardinal prominence of *Terebratula dorsata*, prove that it served as a muscular fulcrum, and there is every reason to suppose that the cardinal muscles were attached to it‡. M. Bouchard Chantereaux appears

\* The use of the so-called pedicle seems to be twofold—to moor the shell to foreign bodies, and to serve as a fulcrum for certain muscles. In the *Strophomenas* and *Leptænas* generally, owing to the deltidium being cicatrized, or occupied by the base of the cardinal tubercle, the pedicle can only have been used for the latter purpose; in *S. alternata*, *L. analoga*, &c., which have a foramen, it would answer both. The same remark applies to the *Orthises* (*O. anomala*) and *Spirifers* (*S. heteroclitus*, &c.): as the deltidium is often open in the last genus, it appears to have served as a passage for the pedicle. From the closing of the foramen in old individuals of many species of *Terebratula* (*T. variabilis*, *T. carnea*, &c.), *Leptæna* (*L. analoga*), *Hypothyris* and other genera, it is evident that the pedicle was occasionally dispensed with in old age. In young *Strigocephalus* the pedicle passed through an open deltidium, as in many *Spirifers*; in individuals more advanced it passed through a circular aperture in the cicatrix of the deltidium (in which case it is an “entire, subapical foramen,” resembling that of many *Hypothyrises*); in full-grown individuals the pedicle was dispensed with, as the deltidium is completely cicatrized. M. Verneuil informs me that the deltidium is exposed and open in young specimens of *Pentamerus Knightii*; it is well known to be concealed in old ones: in another species of the same genus (*P. conchidium*) it is exposed and open. It will thus be evident, although neither foramen nor deltidium is to be seen in *Productus*, that this is no evidence of its having been without a pedicle mass.

† The ramified impressions on the two valves of *Productus* are generally considered to have been produced by the viscera; nor was it until lately, and after seeing that the fibres of the muscles of *Terebratula dorsata* had a ramified arrangement, that I could be induced to think otherwise. The stopper muscle of certain species of *Anomia* produce a similar ramified impression on the upper valve.

‡ M. Verneuil, speaking of *Productus*, says, “La valve ventrale possède une forte dent médiane, quelquefois simple, plus souvent bifurquée ou trifurquée à son extrémité, et représentant les deux ou trois dents des *Orthis* et des *Leptæna* réunies et soudées ensemble.” (Geology of Russia, vol. ii. p. 251.) This so-called tooth, with its bipartite or tripartite extremity, I have never seen fitting into a correspondingly divided depression; therefore, irrespectively of the counter-evidence given in the text, this fact alone is sufficient to prove that it is not an articulating instrument.



to be the only one whose view refers the tubercle to the office of a muscular fulcrum ; but he has fallen into an error in supposing that it supported the pedicle or muscle of attachment\*.

Before concluding this brief account of the internal characters of *Productus*, we must not overlook its mode of articulation, nor the two crescent-shaped bodies often seen on its flat valve. By some these crescent-shaped bodies are supposed to have been produced by certain muscles ; on the other hand, there are many who think that they have been the supports of the labial processes. From the specimen of *Productus comoides*, which is figured by Von Buch, exhibiting a pair of gyrate impressions† (the same are even more obviously displayed on one of my specimens of *Productus giganteus*), I have no doubt that the mollusk of this genus was furnished with spirally-folded labial appendages : I hope to be able however to show clearly in my monograph, that the crescent-shaped bodies did not support these appendages, but, on the contrary, that they were produced by the ovaries. Respecting the articulation of *Productus*, I have long been convinced that it is effected without the presence of teeth or condyles : by taking the tubercle or cardinal muscular support for an articulating instrument, many palæontologists have described the *Productuses* as dentigerous. I have now examined a number of species, and in every one the hinge plate of the flat valve exhibits nothing but the *cardinal muscular support* ; while that of the opposite valve presents a straight continuous surface, only occasionally broken by a notch caused by the pressure of the part just mentioned‡.

[To be continued.]

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#### VI.—On *Ginnania furcellata*. By GIUS. DE NOTARIS§.

THE celebrated Professor Meneghini, in his excellent work on Mediterranean and Dalmatian Algæ, has justly observed, that the commonest species are often those whose peculiarities of internal structure are, in fact, least known, either because they are supposed to have been already sufficiently illustrated, or because they are regarded, I might almost say, with contempt. Of this number, if I mistake not, is the *Halymenia furcellata* of Agardh, a species common enough on the coasts of England and western France and in some parts of the Mediterranean ; and although

\* Annales des Sciences Naturelles, tome xviii.

† Ueber *Productus* oder *Leptæna*.

‡ Certain so-called *Productuses* are known to be dentigerous, but these will be hereafter shown to constitute another genus.

§ Extracted from a paper entitled "Sopra alcune Alghe del mare Ligustico." Communicated by the Rev. M. J. Berkeley.